

of the prongs of the fork on the air? A simple experiment will answer this question.

Place three lighted candles on the table at A, B, and C (Fig. 13). Hold the hands upright, with the space between the palms opposite A, while the backs of the hands face the candles B and C. Now move the hands near each other, then separate them, and make these motions steadily and not too quickly. You thus repeat the motions of the prongs of the fork. While vibrating the hands observe attentively the flames of the candles. When the hands are coming nearer each other, the air is

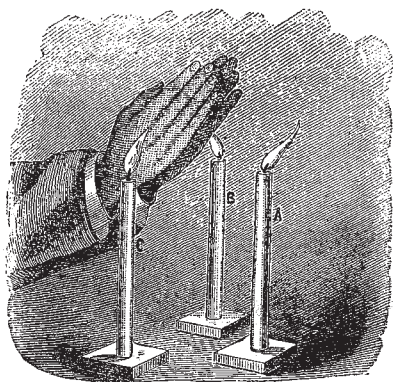


FIG. 13.

forced out from between them, and a puff of air is driven against the flame A, as is shown by its bending away from the hands. But, during the above movement, the backs of the hands have drawn the flame toward them, as shown in Fig. 13. When the hands are separating, the air rushes in between them, and the flame A is drawn toward the hands by this motion of the air, while at the same time the flames at B and C are driven away from the backs of the hands. From this experiment it is seen that the space between the prongs and the faces of the prongs

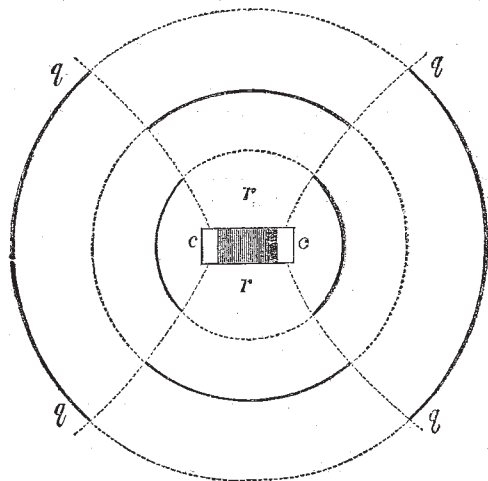


FIG. 14.

of a fork are, at the same instant, always acting oppositely on the air.

This will be made clearer by the study of the diagram, Fig. 14.

This figure supposes the student looking down on the tops of the prongs of the fork. Imagine the prongs swinging away from each other in their vibration. Then the action of the faces *c* and *c* on the air is to condense it, and this condensation tends to spread all around the fork. But, by the same movement, the space *rr* between

the prongs is enlarged, and hence a rarefaction is made there. This rarefaction also spreads all around the fork. But, as the condensations produced at *c* and *c* and the rarefaction at *r* and *r* spread with the same velocity, it follows that they must meet along the dotted lines *q, q, q, q*, drawn from the edges of the fork outwards. The black $\frac{1}{4}$ -circle lines around the fork in Fig. 14 represent the middle of the condensed shells of air, while the dotted $\frac{1}{4}$ -circle lines stand for the middle of the rarefied shells of air.

Now what must happen along these dotted lines, or, rather, surfaces? Evidently there is a struggle here between the condensations and the rarefactions. The former tend to make the molecules of air go nearer together, the latter try to separate them; but, as these actions are equal, and as the air is pulled in opposite directions at the same time, it remains at rest—does not vibrate. Therefore, along the surfaces *q, q, q, q*, there is silence. When the prongs vibrate toward each other they make the reverse actions on the air; that is, rarefactions are now sent out from *c* and *c*, while condensations are sent from *r* and *r*, but the same effect of silence along *q, q, q, q* is produced.

Experiment 15.—That this is so is readily proved by the following simple experiment:—Vibrate the fork and hold it upright near the ear. Now slowly turn it round. During one revolution of the fork on its foot you will perceive that the sound goes through four changes. Four times it was loud, and four times it was almost, if not quite gone. Twirl the fork before the ear of a companion; he will tell you when it makes the loudest sound and when it becomes silent. You will find that when it is loudest the faces *c, c* of the prongs, or the spaces *r, r* between them, are facing his ear; and when he tells you that there is silence you will find that the edges of the fork, that is, the planes *q, q, q, q*, are toward his ear.

(To be continued.)

ON AN ASCENT OF MOUNT HEKLA, AND ON THE ERUPTION OF FEBRUARY 27, 1878

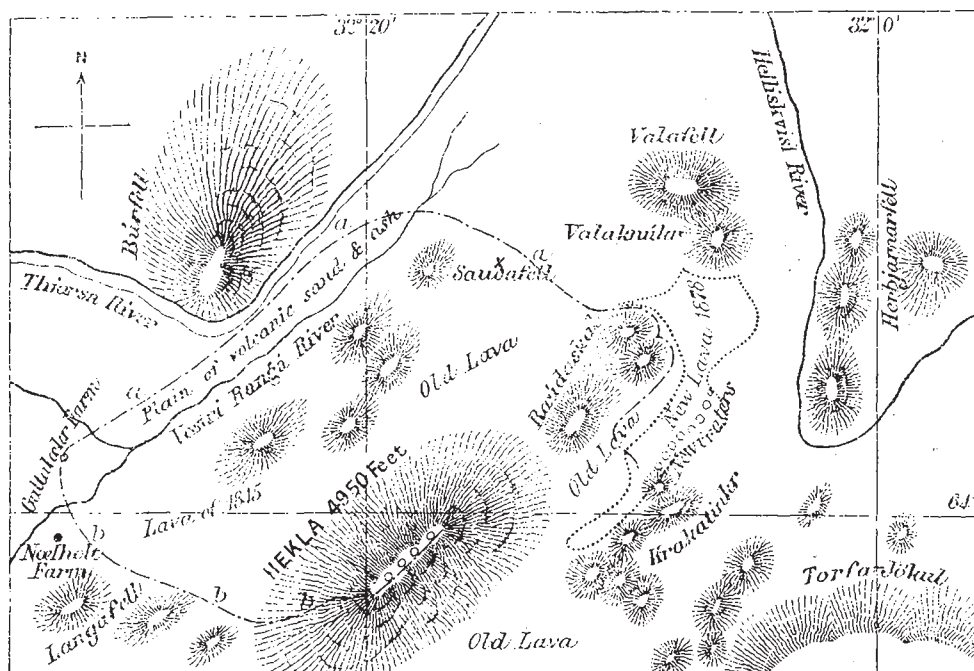
ON February 27 last severe earthquakes were felt throughout the south-west portion of Iceland, particularly in the districts of Land, Rangaröllir, Hreppa, and Fljotschlith, which are situated immediately to the south and south-west of Mount Hekla. Between 8 and 9 P.M. an intense illumination of the sky, at first believed to be actual fire, was seen to the south-east. This was found to be due to the reflection by clouds of the light emitted by molten lava within a subsidiary crater, or *bocca del fuoco*, as the Italians would call it, of Hekla. On the following day dense columns of smoke ascended from the crater, and quantities of volcanic ashes fell in the districts of Hreppa and Biskupstundur. The light was seen at Reykjavik, nearly seventy miles distant, and there appeared to be two vents of fire.

One month after the eruption Prof. Tómas Hallgrímson visited the district and endeavoured to discover the exact position of the new crater. He found it in the Ráðaskal Valley, about four miles to the north-east of Hekla, and in connection with one of its outlying spurs. The chief crater was observed to be near the northern base of Krakatink, and a good deal of new lava was heaped around it. Herr Nielsens, a merchant of Eyrbakki, on the southern coast of Iceland, visited the scene of the eruption about the same time, and by ascending Krakatink he was able to look down into the new crater. He also determined its position, and traced the course of the new lava streams. The map which is here reproduced (for which I am indebted to Sjöra Gudmundr Jónsson, the priest of Stóruvellir, a hamlet near to Hekla) is a copy of Nielsens' sketch made on the spot.

Upwards of a month ago (August 21) I visited the scene

of the eruption, in company with three friends. Two guides accompanied us, and we took a relay of ponies in case of accident or fatigue. We left the Galtalækur farm (see the map, route *aa*) at 7.30 A.M., crossed a small streamlet, and soon came upon a growth of dwarf birch-trees from one to two feet in height. Here we put up a covey of very tame ptarmigan. On emerging from the under-wood we entered a long level plain of volcanic sand and ash, extending between the river Thiorsa and the smaller stream called Vestri-Rángá. We cantered over the plain for about ten miles, turning aside for a moment to look at the falls of the Thiorsa, at the southern base of Búrfell. The substance of the plain is black volcanic sand and ash, with occasional white, grey, and red patches of pumice. At 9.15 A.M. we found ourselves near the termination of the Vestri-Rángá, and, bearing to the south-east, we forded the stream, and almost immediately afterwards came upon fields of volcanic ash and lava. The ground now became very rough, masses

of lava were strewn in all directions, and there was of course no track. We passed several cones of ashes emitted by extinct craters, and presently saw in front of us Ráudaskal—the red mountain—a subsidiary cone probably thrown up in 1554. We wound along the Ráudaskal valley, which is between six and seven miles in length and nearly two miles broad, passing by the base of several large cinder-cones. The new lava of 1878 was soon sighted, and we picked our way for about three miles between the edge of the field and the sloping sides of the cinder cones. By the time we had ridden some twenty-three miles from Galtalækur we found ourselves at the edge of a field of old lava, contiguous to the lava of 1878, and in sight of the largest of the new craters. The summit of Hekla was on our right, about four miles distant, and Krakatinkr was nearly facing us to the south. Here we left the ponies, tied head and tail together, to prevent straying during our absence. The only possible way to get nearer to the new crater was to clamber over the old



Map of Mount Hekla showing position of the new craters. Route *aa*, from Galtalækur to the new craters. Route *bb*, from Galtalækur to the summit Hekla. The dotted line between Valaknukr and Krakatinkr shows the position and extent of the lava field of 1878.

Scale $\frac{1}{240,000}$. $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{1}$ $\frac{1}{2}$ Miles Danish.

bed of lava, which, although very rough and jagged, was not difficult to cross, on account of its covering of moss. At the edge of this bed we came upon a small tract of old snow, covered with volcanic ash to the depth of about eight inches. Then we reached the new lava and saw the largest cone of the new craters immediately in front of us, and about half-a-mile distant. The new lava was more rough and cindery, at least at the surface, than any I have ever seen around Etna or Vesuvius. Its surface was extremely jagged, and it was broken into ridges, and crests, and sharp pinnacles, which yielded uncertain support to the foot or hand. Hence it was both difficult and dangerous to cross, and we could only climb over a few dozen yards of it. Standing upon its surface we could see the cone of the largest of the new craters emitting small quantities of vapour and incrustated with red and yellow substances. The lava field extended both to our right and left, and in some places it was giving off vapour. The edge of the

field along which we travelled was about twenty feet in depth, but in some places it was piled to a much greater height. The lava was very close and compact some distance from the exterior; it was cracked and split in all directions. White incrustations of salt (not chloride of ammonium, which is common in some lavas) were often noticed at the points of fracture; also brilliant red and yellow incrustations, which are often mistaken for sulphur, but which in the case of this lava, at least, I have proved to be *sesquichloride of iron*. In some parts of the lava these incrustations covered many square yards, while fumes of hydrochloric acid were freely emitted in their vicinity. The sesquichloride when removed from the lava rapidly absorbed moisture from the air and formed an intensely acid solution. We left the neighbourhood of the new crater at 2.30 P.M., rested at 4 P.M. on the banks of the Vestri-Rángá, and reached Galtalækur at 6.15 P.M., having left it eleven hours before, and travelled over nearly fifty miles of volcanic country.

Two short accounts of the eruption have been published in Icelandic, the one by Prof. Hallgrímson, the other by Herr Nielsens. These have been translated for me by Herr Matthias Jockumsson, of Reykjavik, to whom I beg to express my acknowledgments. According to Hallgrímson there are fourteen small craters situated in a line passing from west-south-west to east-north-east, which line, if prolonged, would pass through the centre of the craters on the summit of Hekla. The distance between the extreme craters of February 27 is about 6,000 feet. The lava flowed more than a mile to the south of the largest of the new craters, but the main stream flowed to the north and north-east, and nearly reached the Mountain Valaknúkr.

Nielsens approached the scene of the eruption, a month after its commencement, from the north-west, and passing between Valafell and Valaknúkr, he went due south to Krakatinkr, along the eastern edge of the new lava. From the summit of Krakatinkr he looked down into the principal crater, and saw that it opened towards the east, and that its sides were almost perpendicular. The lava within it was seen to be agitated by a wavy motion like the billows of the sea, and a stream of glowing lava was moving towards the south. A good deal of vapour was apparent, and loud noises, as of the roaring of the sea. The valley is most steep, in a line which passes north-west and south-east from Raudfossafall; here, consequently, was the greatest depth of lava. The stream varies from 10 to 100 feet in thickness, and in some places it has burrowed beneath the snow and ice. The lava is almost black in colour, and closely resembles the old Hekla lavas in texture; as it cooled it split up with great noise and commotion.

Nielsens again visited the neighbourhood of the new crater on June 9. The lava had not increased in quantity since the beginning of April, but columns of vapour still arose from it, and small quantities of ashes and of pumice had fallen during April and May. He crossed the warm lava and managed to ascend the largest crater, which was found to be 90 feet in depth and about 100 feet in circumference.

Two days after our visit to the scene of the eruption of February 27 we ascended Mount Hekla from the south-west. The general details of the ascent I now copy from my journal, hoping at some future time to produce them in a less desultory form, and to give an account of the analysis of some of the lavas of Hekla.

We left Galtalekr Farm at 9.40 A.M., taking with us G. Zöega, a guide from Reykjavik, together with the occupant of the Næfholt Farm, on the flanks of Hekla. (Route *bb* on the map). Having crossed the Vestri-Rángá, we proceeded nearly due south, passed the Næfholt Farm, near which we came upon the lava of 1845; and then passed over some very rough lava-strewn ground covered with volcanic ash, which concealed holes into which the ponies sometimes stumbled and fell. The lava of 1845 is covered with the same moss which we noticed on the old lava near the crater of 1878, which causes it to look much older. When the ascent became greater, we left the ponies. Distance to foot of steep incline about seven miles from Galtalekr. Followed the southern boundary of the lava-field of 1845, until we reached a steep incline which we ascended. Crossed a small portion of the old lava field, then a tract covered with volcanic ashes, and finally found ourselves at the bottom of a steep slope covered with snow, beneath which water was heard rushing downwards. The ascent of this slope without alpenstocks was not easy. Several other snow slopes were crossed, and we then found ourselves near the crater of 1845—the most westerly of the four craters on the summit of Hekla. Above this we saw a crater with a red smoking mound within it; then in succession the third and fourth craters, and beyond the most easterly crater a nearly level snow-covered waste full of lava

blocks. From the most easterly extremity of this, which was reached at 2.30 P.M., we looked down upon the principal crater of 1878. The summit of Hekla is covered with much ash, sand, and red pumice, together with lavas of every degree of compactness, from the most vesicular up to obsidian. The descent over the snow-slopes was troublesome, on account of their steepness and the slipperiness of the snow, but we regained the spot at which we had left the ponies at 5 P.M.

Hekla was ascended for the first time in the year 1770. The difficulties of the ascent have been much exaggerated subsequently. Many travellers have made no attempt to scale the mountain. Even the "American in Iceland," who was in the neighbourhood of Hekla only three years ago, asserts that "the obstacles, real and imaginary, stated to be in the way, such as tortuous and difficult paths, swollen rivers, depth of snow, treacherous bogs, and the evident indisposition of the guides, perhaps from superstitious fears, to make the attempt, compelled us to turn our backs upon this snowy monarch of Iceland." Other writers speak of the "fearful precipices" and of places where "a slip would be to roll to destruction."

The fact is, it is quite an easy mountain to climb, in witness whereof I may mention the very abnormal conditions under which I ascended it. The day preceding our ascent had been extremely wet, and there was at least a possibility of a downpour on the day itself; moreover, there were streams to ford, and I had consequently put on waterproof wading stockings, and the usual accompaniment of thick iron-clad wading clogs, which, although the most cumbersome things in the world to walk in, are well suited for riding in the humid climate of Iceland. If the steepness and length of the ascent had required it, of course I should have left these encumbrances with the ponies, but it was quite unnecessary, and I accomplished the ascent without difficulty in this unwieldy equipment. Surely a mountain of this height was never before ascended in clogs and waders, and the fact of its being possible to do so without inconvenience, is a sufficient answer to those who would make the ascent of Hekla a dangerous and difficult feat.

G. F. RODWELL

NOTES

THE moderation in tone of Viscount Cardwell's short address at the opening of Owens College, makes his estimate of the position of that institution all the more worthy of acceptance. He is inclined to regard it as the most singular acquisition to the academical strength of the county since the middle ages; and we venture to think that one chief reason why it occupies so distinguished a position is the completeness, the all-roundness of the education which it furnishes. There, science and letters are on an equal footing, and it will only be when this is the case in all our educational institutions that the educational apparatus of the country will be thoroughly efficient. The fact that Owens College now administers funds exceeding 400,000*l.*, all obtained from private sources, is one proof that it fills a great want. We have on previous occasions spoken of its claims to be erected into a university. The tone of Lord Carnarvon's address at Saltaire, was in effect similar to that of Lord Cardwell; education is incomplete unless all our faculties have equally fair play.

ACCORDING to the Naples correspondent of the *Times*, Prof. Palmieri does not think there is any likelihood of a violent eruption of Vesuvius. The mountain has been in an eruptive state for two years; the cup is full, and must run over, but will probably do so quietly. The state of Vesuvius gives some interest to the project of the construction of a railway intended to conduct travellers from Naples to the margin of the crater. The scheme, proposed by a Neapolitan banker, has just been adopted.